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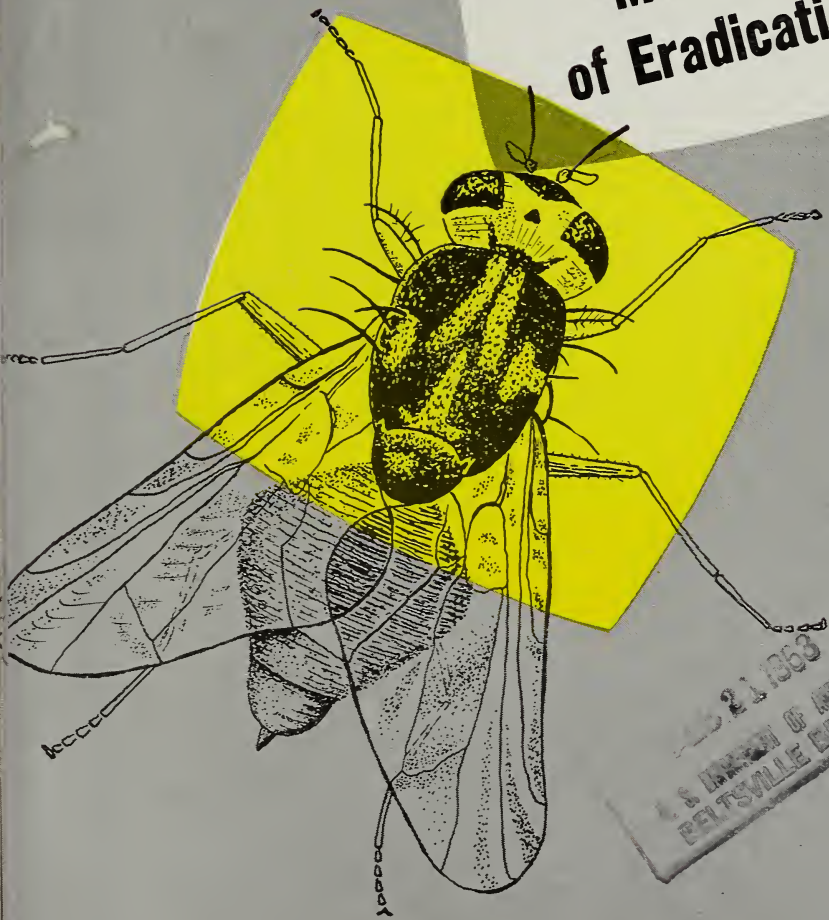
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the Mediterranean Fruit Fly

Methods
of Eradication



APR 21 1963
U.S. DEPT. OF AGRICULTURE
PELTSVILLE BRANCH

PA No. 301
UNITED STATES DEPARTMENT OF AGRICULTURE

The Mediterranean Fruit Fly



The Mediterranean fruit fly¹ is one of the world's most destructive agricultural pests. It attacks more than 200 fruit and vegetable crops and in some countries has made commercial fruit production difficult or impossible.

This pest has been found in the continental United States three times—1929, 1956, and 1962—all three times in Florida.

The 1929 infestation involved 20 counties in central Florida. It was eradicated in late 1930 at a cost of about \$7.5 million. Eradication was achieved by destroying the fruit fly's food supply—literally millions of dollars' worth of citrus and other fruit.

Another infestation was discovered in April 1956, in Greater Miami and nearby areas. It eventually spread to 28 counties before it was eradicated in slightly over 1½ years at a cost of about \$10 million. The availability of an effective insecticide at that time made it possible to eradicate the pest without the destruction of host fruit.

DAMAGE

Extent of Damage

The exact amount of damage done by this pest each year over the world has never been determined. Its economic importance varies from country to country.

- In Greece, up to half of the citrus crop has been lost some years, and damage to summer fruits is even greater.
- In 1950, at least 80 percent of the peach crop in Sardinia was lost; and apple, pear and

In June 1962, the fly was captured for the third time in one of the 8,000 traps maintained in Florida since 1957. Federal and State plant pest control officials arranged immediately to regulate movement of host material and to begin insecticidal treatments.

Because of the early detection of the pest and quick action by control workers, the fruit fly had spread into only three counties—Dade, Broward, and Palm Beach—by August 1962. Agricultural officials hoped to keep the Medfly out of the commercial fruit growing areas and to eradicate the pest at a fraction of the cost of the two previous infestations.

Experts estimate that it would cost the Florida citrus industry at least \$20 million each year to "live with" this pest—plus untold trouble and inconvenience. Also, an established infestation in Florida would be a constant threat to fruit and vegetable growers in other States.

orange crops were seriously damaged.

- In some areas of Africa and South America this pest has made commercial fruit production difficult or impossible. In North Africa's coastal and irrigated areas of high humidity, the insect is particularly damaging to peaches, pears, and apricots.
- In Brazil, it attacks fruit, coffee, and many other plants.

¹ *Ceratitis capitata* Weid.

MEDITERRANEAN FRUIT FLY

A, Life stages: a, larva;
b, pupa; c, adult fe-
male; d, head of male.
(All greatly enlarged.)

B, Infested grapefruit with
advanced internal and
external damage. Lar-
vae about natural size.



Muscatelli 1956

Nature of Damage

The female fly punctures the fruit and lays eggs just beneath the skin. The eggs hatch into larvae, which burrow deeper into the fruit, where they feed and develop. The fruit spoils and usually falls to the ground. Loss of fruit also occurs from rots that develop about the fly stings, whether eggs are deposited or not.

Crops Attacked

Preferred hosts among this country's major fruit crops include:

ORIGIN AND SPREAD

A native of tropical Africa and well established throughout the Mediterranean area, the fly is a notorious world traveler. Since 1863, it has been found in Bermuda, other Atlantic islands, Australia, South America, and Hawaii. An extensive infestation discovered in Costa Rica in 1955 has since spread into Nicaragua.

The insect is spread chiefly in infested fruits shipped commercially or carried by tourists. With increased travel between countries, it is a constant threat to our fruit industry. Federal plant quarantine

Peaches, pears, plums, apples, and most citrus fruits. Lemons appear to be practically immune to attack and ordinarily only overripe sour limes become infested.

In Florida, the most susceptible hosts of the Mediterranean fruit fly include: Calamondin, Surinam cherry, peach, sour orange, kumquat, grapefruit, and mango. Other preferred hosts are orange, papaya, guava, loquat, rose apple, and tropical almond. Avocados and green peppers may be subject to light infestations but most vegetables are not hosts of this fruit fly.

inspectors have prevented its entry into the United States literally thousands of times by intercepting it at ports of entry. They have found it in passengers' baggage in fruit that harbors the insect in one or more of its forms.

A strong flier, the pest can spread quickly by natural flight once it is established in a locality. It is helped along by wind drift and by transportation of infested fruit, vegetables, or soil moved from place to place. The fly also hitchhikes from an infested area in automobiles, trucks, airplanes, boats, and other vehicles.

DEVELOPMENT AND APPEARANCE

The Mediterranean fruit fly can produce about 10 generations a year. It has four life stages—adult (fly), egg, larva (maggot), and pupa.

The adult is slightly smaller than a housefly and its body is yellow tinged with a brown. The part of the body that bears the legs is marbled with shiny black splotches. The oval abdomen has two fairly broad silvery bands. The wings, usually extended and slightly drooping, are transparent with brown or black markings. Adults usually live 30 to 60 days.

The female adult pierces the skin of a host fruit with the needle-like ovipositor (egg-laying apparatus) at the end of the abdomen. She then deposits 1 to 10 eggs in this puncture. This same puncture may be used by other females; several hundred eggs have been found in a single cavity. Under favorable conditions female flies probably lay an average of 300 eggs or more during their lifetime.

The tiny, elongated eggs—barely visible to the naked eye—hatch into larvae within 2 to 4 days.

The larva is a slender, cream-colored maggot. It completes its development in 7 to 11 days and when mature leaves the fruit and enters the soil. By this time the fruit has usually dropped to the ground. It requires specialized training to distinguish the Mediterranean fruit fly larvae from similar pests.

FEDERAL-STATE PROGRAM

Quick eradication always has been the objective of Federal-State programs against the Mediterranean fruit fly. To accomplish this objective, the program is divided into three phases: survey, quarantine, and control.

Surveys

Plant pest control workers continually operate traps for the Medfly. This detection system, which has been in operation since the fly was eradicated from Florida in 1957, makes quick action against the invader possible.

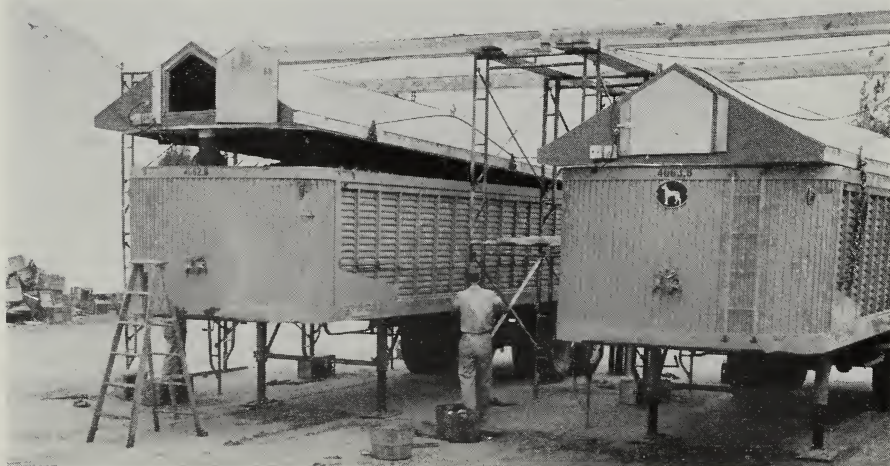
As soon as the first fruit fly is found, plant pest control workers begin more intensive surveys to lo-

In the soil the larva changes into a pupa. Within 8 to 14 days the pupa changes into an adult fly which then emerges from the soil.

After the flies become sexually mature (in 4 to 5 days or more depending upon temperature) they mate, the female lays eggs, and the life cycle begins again.

cate and delimit infested areas. To fight the 1962 invasion, plant pest control specialists of USDA's Agricultural Research Service and the Florida State Department of Agriculture were sent immediately to the Miami area to give local pest control workers there a helping hand in survey and eradication activities.

Fruit fly traps, set up at strategic points, are baited with oil of angelica seed or trimedlure, both powerful attractants for the male fruit fly. Spot infestations are located by the surveys and sprayed within hours after they are discovered.



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The fumigation hood being lowered on a load of citrus is one of the devices used to fumigate fruit leaving a quarantined area.

Traps are used also to check the effectiveness of control measures in the infested area.

Quarantines

Federal and State quarantine regulations to prevent the spread of the Mediterranean fruit fly to uninfested areas are put into effect promptly after the discovery of an infestation.

Federal quarantine regulates the movement from one State to another of any articles that may harbor the fruit fly. State regulations control movement of these articles to uninfested parts of the State.

Regulated articles consist principally of:

- Fruits, some vegetables, and other garden and orchard products.
- Sand, soil, earth, peat, compost, and manure.
- Fruit-picking equipment.
- Trucks, wagons, cars, aircraft, boats, and other means of conveyance, and containers used in conveying fruits or vegetables.
- Other products and articles that have been associated with the production of or commerce in fruits and vegetables or that have been or are contaminated with sand, soil, earth, peat, compost, or manure.

Federal and State inspectors issue certificates for the transportation of regulated articles under one or more of the following conditions:

- The articles have not, in the judgment of the inspector, been exposed to infestation.
- They have been examined by an inspector and found to be free from infestation.
- They have been treated under the observation of an inspector according to approved methods that make the ar-

ticles safe to transport into uninfested areas. Citrus fruit, for example, may be made safe to transport by fumigation with ethylene dibromide.

Treatment

Bait spray

One of the main weapons used in the fight against the adult fruit fly is bait spray applied to vegetation by airplanes and ground sprayers. Properly applied, this spray is not harmful to human beings or animals.

The spray contains an insecticide (malathion 25 percent wettable powder) and a bait (enzymatic or acid protein hydrolysates). The bait contains certain essential fruit fly nutrients that make it attractive to the flies. Deposits of this spray usually attract twice as many females as males.

Because flies seek out and feed on the bait, complete coverage of each tree or plant is not required. Also, less insecticide is needed to make this spray effective than for spray materials requiring contact with the insect.

The spray is prepared by mixing 1.2 pounds of 25-percent wettable malathion powder and $\frac{6}{10}$ pound of protein hydrolysate solids with 1 gallon or more of water. This amount is applied on each acre.

The bait is applied uniformly in a coarse spray over the area at a 7-day interval. Spray deposits on foliage are more attractive to the flies than deposits on the trunks, limbs, or fruit of the trees.

Soil Treatment

Insecticides are applied in granular form under host trees in addition to the other control measures. These insecticides applied to the soil will kill some larvae as they enter the soil to pupate and most of the adults as they emerge from the soil.



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Airplanes and ground sprayers are used to apply malathion-bait spray to vegetation in infested areas. This spray is one of the main weapons used in the fight against the adult Mediterranean fruit fly.

HOW YOU CAN HELP

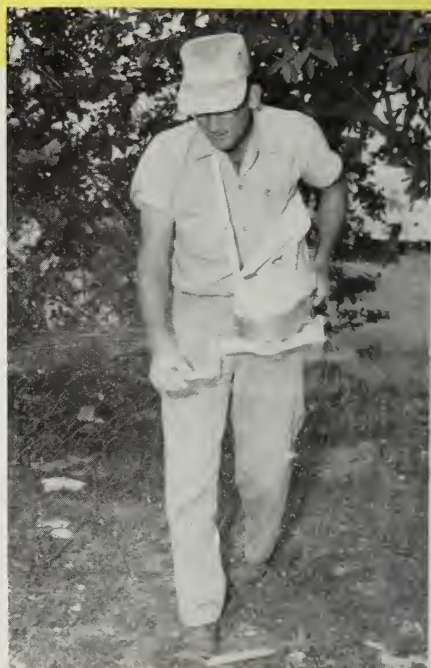
It is vitally important that the Mediterranean fruit fly be kept from becoming permanently established in this country. You can cooperate in several ways in the fight against this dreaded pest:

- Pick up and destroy all dropped fruit.
- If you see a fly or larva resembling those pictured in this publication, report this discovery to your local State or Federal plant pest control official or county agent.
- Give control workers free access to your property for applying insecticides, operating traps, and inspecting fruits.
- Cooperate with quarantine officials: Do not take any fruit, vegetables, soil, or other articles that may harbor the pest out of the infested area unless you comply with quarantine regulations.
- When area-wide sprays are applied in your locality, follow the suggestions of the control officials concerning ways you can cooperate. You will read or hear these suggestions in your local newspapers, radio, and TV stations.

This publication was prepared by the Plant Pest Control Division and the Entomology Research Division, Agricultural Research Service.

Washington, D.C.

Revised January 1963



N-18498

Granular insecticides are applied under host trees to kill larvae as they enter the soil and flies as they emerge.